STAT

Page Denied

TECHNICAL INTELLIGENCE TRANSLATION

(Title Unclassified)
SELECTED ARTICLES

by

Various Authors

from

Grazhdanskaya Aviatsiya Nr. 1, January 1957

Pages 3-5, 8-9, 11, 12-13, 15-17, 18-19

AIR TECHNICAL INTELLIGENCE CENTER
WRIGHT-PATTERSON AIR FORCE BASE
OHIO

TABLE OF CONTENTS

On a New Path
by
I. Lapkin and M. Polupinskiy

For a long time the line repair shops at the Takirsk Airfield have performed very poorly. Because of their fault, there were frequent delays and disruptions in travels. The disruption in flight schedule hampered the execution of the transportation plan and caused dissatisfaction among passengers and load dispatchers, it nullified the efforts of workers of other services in their struggle for higher technical-economical results.

Toward the end of 1955, when aircraft flight with alternating crews came into effect, it became perfectly clear that the obsolete working methods could not be applied to the new conditions. Things became further aggravated by the fact that flight offices began making preparations for flights without aircraft mechanics on board, and the LFRM (Avia-Repair Shops?) were confronted with much higher requirements. The collective was getting ready for the 20th Congress of the Communist Party of the USSR and has evaluated anew its activities. A radical reorganization of the productive process was necessary so that the flight groups could fully utilize all advantages of aircraft operation with alternating crews.

The decisive role here was the mass-political and organizational work of the party organization. The problem of reorganizing the operations of the LFRM was discussed during party meetings and later during trade union meetings. Making a thorough analysis of their activities, the engineers, mechanics and other laborers have contributed many valuable suggestions on the organization of work, planning and material securing. In discussing these problems, an idea came up about keeping a monthly chart of aircraft brought for servicing.

In many line repair shops, there are often unpleasant "surprises" when several aircraft are brought in at once for the difficult regulation servicing. The work cycle is immediately interrupted and the time loss increases sharply. This naturally brings complications into the operations of flight units and the airfield and delays the scheduled departure of aircraft.

It is evident that such "surprises" always originate as a result of lack of accurate coordination between flight and repair shop crews. The charts of aircraft brought for servicing, compiled jointly by the flight groups and the LFRM eliminate the irregular loading of passengers and parcels and at the same time assure regular operation. This chart indicates the route and time of aircraft flight, arrival time at the base, and the rules governing the servicing of aircraft.

Now the shop bosses know ahead of time on what day and hour and for what kind of servicing any particular aircraft will be brought in. In conformity with this, the airfield management plans the working hours for the technical service personnel. At the same time the chart helps to regulate the activities of the flight groups. The commander of a group, knowing beforehand the number of operational aircraft at his disposal each day, prepares the most proper operations plan for the crews and for the utilization of equipment.

For example, here are the monthly operations of the Li-2 L4959. On the 2nd day of the month, it returned from Moscow, was given a 50-hr service checkup and on the same day flew to Mineral'nye Vody (Mineral Waters). On the 3rd it arrived in Baku and again flew to Mineral'nye Vody. On the next day it returned to base and was dispatched to Kharkov. On the 5th, the aircraft flew from Kharkov to Baku. On the following day, it was dispatched from Baku to Mineral'nye Vody. On the 7th, trips Mineral'nye Vody-Baku and Baku-Moscow took place. The next two days included return to base, and on the 10th, a flight from Baku to Mineral'nye Vody. On the morning of the day following the return to base, the aircraft underwent a 200-hr. service check. In the evening the Li-2 was dispatched to Mineral'nye Vody. During the following days of the month the aircraft flew Makhachkala-Moscow, Baku-Kharkov, and Baku-Moscow. On the 26th, as specified by the chart, the aircraft underwent a 100-hr. servicing.

We will quote another example. The engine resources of the Il-12 L1794 aircraft at the beginning of the month were coming to an end. With this in mind, the management of the flight section of the LERM prepared charts for the operation of the aircraft. During the first two

Fig. 1. The Bakinsk (Baku) Line Repair Shops

days, the aircraft made the short hops on the Baku-Krasnovodsk line. On the third, it had its engines changed and on the following day after a test flight it was dispatched on the Baku-Moscow trip. On this line it operated to the end of the month during which time the aircraft had a 50 and 100 hr. flight service servicing.

The service chart has actually become the basis for proper cooperation between the flight and shop crews. This made it possible for the worker of the Bakinsk LERM to secure full and timely operations even in the very intensified period of summer travel. It is sufficient to say that three Il-12 aircraft of this base have made continuous double daily trips along the Baku-Moscow-Baku route. The flying time of each registered aircraft has increased considerably. In 1955 the flying time per Li-2 aircraft was 104 and for the Il-12 was 129 hours per month. In the third quarter of 1956, the average monthly flying time for each Li-2 and Il-12 has increased to 140 and 168 hours respectively. Some aircraft had to put in even more hours, for example in June the Il-12 L1894 flew 300 hrs.

Of course the Bakinsk personnel are not the first ones to introduce such a chart. Similar charts are in existence in other flight sections also. However, certain discord exists there between the flight and shop personnel; they operate on an individual basis and when making out charts they think mainly about their own interests and conveniences. Here at our base everything is done for a common purpose, namely to improve the utilization of the airfield and this applies not only on paper but also in practice.

The chart has forced the group to reorganize the operations. Previously we had three workshops here and now we have only one, for technical maintenance. The shops for current repairs and special equipment were broken down into sections. The organizational change has brought not only considerable economy but has freed qualified technical personnel for urgent work in industry. The sections and shifts are now headed by workers with solid training and experience. All shifts are staffed with qualified mechanics, inspectors and helpers.

The working brigades were cut down in number (broken down into smal-

ler units) which, under conditions of the Bakinsk LERM, is perfectly justified. Brigades usually consist of 3 - 4 men and they alternately service the aircraft according to rules. They install and replace engines and thus acquire the experience necessary for many different jobs.

The reorganization of the LERM and above all the improvement in the planning have facilitated the introduction of work time charts for the brigades. Here also the communist became the zealots. The discussion on this problem in the party office was distinguished by concreteness because it has been preceded by a thorough study of the facts directly in the maintenance shops and departments. Collectively, by an interesting consideration of all pros and cons, we found the proper solution. Hence the entire combination of operations involved in the change of engines, beginning with the unpacking and ending with the installation is carried out by one brigade according to the time chart. This allows a more uniform operation of the brigade and increases their responsibility for the quality of the job worked on.

The operations according to the time chart at the LERM began for the first time on March 24, 1956. On this day the heavy labor shift under the supervision of comrade engineer Bragin and foreman Comrade Sas changed the engines on the Il-12 L1161. The work began at 7.30 AM and within nine and one-half hours, the aircraft was on its way. The twenty-eight workers of the LERM, including mechanics comrades Comas

POOR ORIGINAL

STAT
STAT

and Vakulenko, technician of the RESOS comrade Laushin, mechanic comrade Rakhimov, engine specialist comrade Khnykin, machinist comrade Derevyankin, painter comrade Ustinova, washwoman comrade Klimakova, checker foreman comrade Vasin all have deserved thanks from the unit commander.

True, the introduction of the time chart was initially hampered by the disorderly work of the current repairs section. The party organization has held meetings twice on the problems of reorganizing this section by helping its foreman, young engineer comrade Volkov, to improve the labor organization and more properly utilize the equipment etc. Today this section works continuously and provides the technical maintenance shop with repaired units and parts.

A lot has been and is being done for the purpose of complete elimination, and wherever this is impossible, a maximum reduction of the nonproductive labor wasting. The senior engineer and the dispatcher have an intercom system connecting them with all shop departments and all airfield services. Two motorcycles with side cars and several bicycles were placed at the disposal of the dispatchers, chiefs and foremen. The motorcycles are also used for transporting units and parts.

Making up a 24 hr. work chart, the labor management determines what kind of service this or any other aircraft is due to undergo, what components will have to be changed, and when the work will be completed. The spare parts store room, having obtained a copy of the daily task, prepares the necessary units, spare parts and materials and, upon the order given by the foreman of the shift, delivers them at a specific

time to the working place of the technical service brigade. The members of the working brigades are relieved of the job of walking to the store room; they need not lose time carrying step ladders, lifting devices and other equipment because all this work is done by the helpers. Reports of defects are handed to shift foremen before the working brigades arrive at the aircraft brought in for servicing.

A group of innovators was instrumental in the reorganization of the work schedule in repair shops. Upon the initiative of the party organization, the technical council prepared a plan as an aid to the innovators and called their attention to the solution of problems most pertinent to the LERM. The plan was evaluated in all particulars and clarified. It was by no means incidental, for example, that during the first half of 1956, a great majority of suggestions introduced by the innovators has been adopted and realized. Upon the suggestion of L. Marsel'skiy, Chief of Office of Tech. Control, screw jacks for the Li-2 were replaced by hydraulic ones. Foreman of the current repair shop, graduate of the Kiev Institute of Engineering of the Civil Air Fleet N. Volkov, made use of an old trolley laying around in the shop and built a convenient washing unit.

The innovators have also devoted their attention to the pure "paper" work. Dispatcher O. Britvan has introduced an original but simple aircraft servicing log book (journal). Each aircraft had a separate sheet in which the necessary data were written in: flight hours, balance of engine resources, when and what kind of servicing had to be carried out, etc.

POOR ORIGINAL

STAT

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/04/03 : CIA-RDP81-01043R004000020003-8

At this point, it should be emphasized that the reorganization, which affected all departments, was directed in different ways. According to the work load, work areas were assigned to various work shops. True, it was necessary to make a radical reorganization, but as a result, all departments and sections work under better hygienic conditions, there is more light, etc. For example, let us take the special equipment section. Originally this unit was situated in a dilapidated shed, but now it is housed in a spacious hall. It is equipped with stands and testing machines; the mechanics here work in white coats. For many years past, the assembly of engines was carried out under the open skies; now a special hall was erected for that purpose. By the way, the workers of the section erected it by themselves. Work rooms, machines, stands, technical equipment, black top coverings and the sodding - all this was brought into shape, reconstructed and improved by the shop workers.

For the supervisory personnel of the LERM, the management of the airfield assigned living quarters, thanks to which it was possible to liquidate the turnover of workers.

The Bakinsk workers attach great importance to the introduction and propagation of progressive experience. The achievements of outstanding workers are being publicized by agitators at the exchanges; there are also technical conferences at which expert aviation mechanics present lectures. Regular "Quality Days" are conducted at which the work of the shops for the week past is thoroughly analyzed.

On the walls of the conference room, in which the technical personnel holds its frequent meetings, one can read reports on the work of the brigades of comrades Ivanchikov, Dukalov, and Goman. The brigade of young communist comrade Goman consists of only 3 men but they can change the engine of an Li-2 within an 8 hr. work day. This is attributed to the fact that the work operations are properly distributed among the workers and the engine is mounted on a frame beforehand. Much attention is devoted to publicizing the work achievements of outstanding workers in the local tabloid "For Quality" which is published every ten days. Even though small in volume, this newspaper is characterized by great frankness; it replies constructively to all problems disturbing the group. The workers respect their newspaper and gladly express their wishes in it.

The work with new methods has added a fresh impetus to socialistic competition. This enveloped all shifts and brigades. Everyone knows the annual obligation of the group, the volume of work per unit which has to be carried out within this or any other month, what kind of labor output must be achieved and other characteristics. On the basis of these data, the brigades assume concrete obligations everyday. The foremen plan for the realization of these obligations. Competition has become real, alive. The bulletin boards carry daily reports on which brigade was best on the day before. The bulletin boards are simple and original: to each one is fastened a loose leaf calendar with space under it for writing the names of the winners. The monthly work results are evaluated at meetings, are then formed into directives and are posted in form of a placard for everyone to see.

The management of the LTRM - chief of work shops comrade Alekseychuk, secretary of the party organization comrade Gurskiy, and department chief comrade Kerimov are not exempted from infractions of labor and technological discipline. They exact penalties from the negligent ones widely employing the power of social standing. Neither do the Bakinsk workers forget about the other side of the disciplinary practice, i.e., incentives for good workers and these are provided not only during celebrations. Many workers of the LTRM receive prizes, some receive letters of commendation for their initiative, perfect preparation of aircraft for flight, for their resourcefulness, etc.

With a working crew smaller than that of 1955, the work shops in 1956 completed a much greater work load. The cost for one single servicing job in 1955 was below the planned cost by 24 rubles and 48 kopecks and during the 9 months of 1956 it decreased by 33 rubles 53 kopecks. All the workers are doing their job to the fullest. In 1956, the average work norms were fulfilled by 145%. The time lost for technical servicing of aircraft was almost 24% below the time planned. In the past year the working conditions of Li-2 aircraft was 96.8% and that of the Il-12 and Il-14 exceeded 98%.

The quality of the technical maintenance of aircraft was improved but there are still instances where aircraft are being dispatched without correction of defects. Mostly this is due to the neglect of the special equipment department. Much remains to be done also for the

[redacted]

proper arrangement of the work day; this will eliminate overtime work, which even if in hidden form, has a certain prevalence. Greater attention should be given to innovators, to a more insistent and broad dissemination of their experiences, to more frequent discussions with people and to assure that each suggestion adopted at workers' meetings should be introduced into practice without red tape. The time chart could also stand further improvement.

[redacted]

Notes on Flying Skill. Training of an Aircraft Commander for Flights under Complex Meteorological Conditions (All-weather Flight Training)
by
A. Zakharevich, Group Commander

As a rule, flights in the winter are carried out under complex meteorological conditions. Low clouds and limited visibility, unstable temperature, rains and snowfalls, danger of ice formation on the aircraft-all these factors complicate the operations of the crews in the air and require high skill from the flying personnel.

Skill does not come by itself. It appears to be the result of systematic and thoughtful training of the flight personnel.

Experience shows that courageous flights are being carried out only by pilots who were trained well. Regardless of how difficult a situation they should encounter during their flights, they do not become confused. Lasting knowledge and practical experience acquired as a result of systematic training enables them to find the proper reasonable solution.

The training of crews is complex and varied. It would be difficult to elucidate all its aspects in one article. We will therefore confine ourselves basically to the single most important and responsible flight element namely, the landing approach.

In our unit we attach great importance to the training of crews, especially crews which are employed in the transportation of passengers. The purpose of this training is to teach the crews how to accomplish a

proper landing even under the most adverse meteorological conditions.

In some places pilots are being trained at a horizontal visibility of not less than 500 meters (1650 ft). It is the belief that such a practice does not meet the purpose. The fact is if a pilot at a vertical visibility of 50 m. (165 ft) will guide the aircraft toward a radio station even at the cost of a deviation from his course, he has enough time to consider the error and correct it. It is another matter when the vertical visibility is 30 m. (99 ft). In this case, there is no time for hesitation. The landing result depends upon how correctly the pilot guided the aircraft toward the radio station by means of instruments. Moreover, at a horizontal visibility of 300 m. (990 ft) the ground or the runway lights, in spite of the information from meteorological station, are often overlooked not from an altitude of 30, but 25 to 30 meters. Consequently, if the crews were not trained in time to operate under such conditions then, in case of further deterioration of the weather, they would be in a highly precarious situation and would be unable to secure a safe landing of the aircraft.

That is why we are striving to teach the flight personnel the landing approach by the SP-50 instrument under conditions of a horizontal visibility, not of 500, but 300 meters.

During the training period, we teach our pilots to maintain a strict descending flight path of the aircraft. We demand that they should maintain a vertical speed established for this particular training with

POOR ORIGINAL

STAT

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/04/03 : CIA-RDP81-01043R004000020003-8

consideration of wind correction.

The descent with a vertical speed deviation of more than 0.5 m/sec as compared with the fixed speed indicates that the commander of the aircraft does not pay sufficient attention to the readings of the gyrohorizon and those of the vertical speed indicator.

Ordinarily, in horizontal flight, the pilots do properly divide their attention between the instruments and strictly observe the established arrangement: gyrohorizon - GPK - gyrohorizon - GPK - vertical speed indicator - speed - altitude (GPK stands for directional gyro translator). But when making the landing approach by the OSP and SP-50 instruments, they frequently do not adhere strictly to this well tested system and lose much time on the observation of other instruments: mostly, they watch the dial of the KUR or PSP-48 which leads to a deterioration of the piloting technique.

The mistake of the pilots in distribution of their attention during landing approach is in many instances explained by the fact that the SHVLP (possibly an Advanced Aviation School - Translator)? has developed and introduced an incorrect (in our opinion) method of handling this important flight element. On page 123 of the instruction booklet on the operations of the Il-12, it is said that the radio compass, radio altimeter, UAP and PSP become the main objects of observation. On the very same page, it is suggested that one look only twice at the indications of the gyrohorizon out of total of fifteen observations of the instruments.

[redacted]

Is this correct? On the basis of experiments we consider it incorrect. The division of attention to instruments during landing approach should be the same as during echelon flight.

In the first place, the pilot must carefully watch the instruments used in instrument flight. The indications of the KUR or PSP-48 dials should be watched only periodically and for the sole purpose of checking accuracy of course and descent.

During the training, we advise the pilot to glance at the KUR indicator only when the aircraft strictly maintains all aspects of the flight and the course and the vertical speed of descent remains unchanged. Most of all, the pilot should pay attention to the basic instruments of instrument flight - the gyrohorizon, GPK and vertical speed indicator. As to the altimeter and airspeed indicator, during the landing approach by OSP and SP-50 systems, they are being watched by one of the crew members and in the case of a deviation from the normal he immediately reports it to the commander of the ship.

The division of attention as explained above makes aircraft piloting easier, secures stable flight, eliminates bank and unstable descent, and, consequently, great airspeed fluctuations. The school of higher (advanced) flight training (SHVLP) should revise its method.

We would like to discuss still another prevailing pilot error.

The Li-2, Il-12 and Il-14 have a tendency of departing from the course at the slightest bank. The pilots are well aware of this.

[redacted]

POOR ORIGINAL

STAT

However, when correcting the position of the aircraft they commit a new error. Let us discuss the origin of it.

Having noticed by the GPK (directional gyro) that the course of the aircraft has changed by several degrees, the pilot steps on the proper pedal and returns the aircraft into initial position. The bank however is not eliminated in this process and the aircraft continues its flight with a slide.

However, it is not difficult to determine bank. Its presence, even if unnoticed by the gyrohorizon, at a uniform power of the engines becomes evident by a slight pressure of the pedal against the foot.

During training, we call attention of the pilots to the possibility of making this error and we demand that they return the aircraft to its original course by light, energetic and strictly coordinated deflections of the rudder and ailerons.

It was proven that no matter how well the pilots were trained for two or three months, the piloting skill of some of the pilots deteriorates considerably. This is explained first of all by the fact that they study the flight elements only during the training hours. Such pilots lose the skill acquired under the leadership of commanders and instructors.

A second, in our opinion, no less essential cause is that the rights of aircraft commanders to conduct individual training under blinds during cruising flights with passengers aboard are limited.

we allow the pilot to make a landing of a passenger aircraft in a fog at a horizontal visibility of 300 meters and simultaneously forbid him to cover the left window of the cockpit enclosure with a blind in good weather when the crew has the possibility of observing the ground, and the operations officer and dispatcher watch the movement of the aircraft over the airfield.

It is believed that this is illogical. The aircraft commanders should be allowed to conduct individual training under blinds under good weather conditions. This would greatly increase (improve) the training of pilots and would reduce the expenditures connected with the training of flight personnel in the air.

An important role in the training of flight personnel is played by pilot-instructors. Much depends upon how well they themselves are skilled in the art of piloting. Some of them commit gross errors. The truth is that in training new pilots they only watch the activities of the trainees and by themselves seldom or never take over the control of the aircraft.

Instructor-pilots should by themselves carry out a part of the flight when training trainees. This will allow them to maintain their qualification at a high level and also improve the training of aircraft commanders to fly under complex meteorological conditions.

Night Flights on the An-2 Aircraft

by

I. Drachenko, Pilot-Instructor

The technique of piloting the An-2 aircraft at night is not complicated, but it requires considerably greater attention than in daytime. During taxiing, for example, the pilots do not immediately notice the increase in the speed of movement. Having discovered this, they apply the brakes energetically. As result of this the aircraft stops suddenly or changes direction.

After the run the aircraft begins to climb at increased angles of attack and the headlights do not illuminate the ground but the air space. In front of the aircraft, a view-hindering screen is formed. Trying to get away from it, some pilots cut off the headlights, not at an altitude of 50 m. as instructed, but at 15 to 20 m. above the ground. The disconnection of headlights at a low altitude may lead to collisions of the aircraft with obstacles.

In a dark night, the windows of the cockpit enclosure reflect the instrument panel. The natural horizon according to which we judge the position of the aircraft in space is not completely visible. In such cases, immediately after the take-off or at the moment the aircraft begins to climb, a change over to piloting by instruments is recommended. However, one should not forget that at low altitudes even the slightest errors in piloting may involve serious consequences.

During the landing approach, some pilots switch on their headlights too soon, i.e., at an altitude of 150 - 100 m. From such an altitude, the headlights do not illuminate the ground. They only work under greater strain and, together with the battery, go out of service in a much shorter time.

There is a serious inadequacy in the air navigation equipment of the An-2. The aircraft has a gyro horizon installed only on the left side of the instrument panel. This hinders the operation of the co-pilot, and to say nothing about the fact that the failure of the gyro horizon complicates the piloting of the aircraft. It would be desirable to have a second gyro horizon installed on the right side of the instrument panel in place of the ШК (navigator's indicator) which is scarcely used.

The training program for night flying on the An-2 is very short. They give for example 8 training flights in a series while 15 to 20 flights are actually required. It is figured that a flight in circle should last six minutes, actually it lasts 8 to 10 min.

The flight into a zone at an altitude of 900 m. is calculated at 20 min.; actually, the climb to this altitude and descent from it require 15 min. There remains almost no time for piloting in the zone - execution of horizontal turning maneuvers, standard turns and spirals. The flight into the zone should be extended to at least 30 - 35 min.

In Central Asia, where the air temperature in the summer is high - up to 45° (113° F), the day flight on the An-2 is accompanied by severe

POOR ORIGINAL

STAT

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/04/03 : CIA-RDP81-01043R004000020003-8

bumps which are exhausting for both crew and passengers. In this region, the flights should be carried out mostly at night and during twilight. The flights should begin an hour and a half before sunrise and continue until 11 AM. Night flights would be most advisable along the Chardzhou-Nukus-Tashauz-Ashkhabad air route which runs basically over desert sands strongly heated in the daytime.

Time to Change from Words to Action

by

M. Hudel'man, Training Instructor

In August 1955, at the training sections of the Ukrainian Territorial Office an original trainer (link-trainer) for the training of flight personnel was introduced. The trainer was designed and constructed by Engineer Tikhonov.

The trainer consists of a system of shifts, instructor's control panel and Li-2 cockpit. The trainer is supplied with an AC-voltage of 110 - 220 v, required input is 850 w.

The trainer works on the principle of reciprocity between electro-radio instruments, light rays and photo-elements. Its equipment allows one to introduce a flight speed value ranging from 0 to 260 km/hr and a wind velocity value of from 0 to 80 km/hr in any given direction, to set the course for take-off and landing at from 0 to 360° and an angle of inclination of the glide path from 2 to 6°.

In the cockpit and on the instructor's instrument panel, we see all the radio- and air navigation instruments, installed on the Li-2 aircraft. They function synchronously and give exactly the same indications as in real flight.

The actual movement of the aircraft relative to VPP (take-off/landing strip) or the airfield is marked by an illuminated point on the panel which is not visible from the cockpit.

POOR ORIGINAL

STAT
STAT

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/04/03 : CIA-RDP81-01043R004000020003-8

The trainer offers the possibility of training in the piloting of aircraft by instruments with the employment of various radio-technical means. It is particularly valuable for the training of flight personnel in piercing of clouds and approach for landing by the OSP-system and course-glide radio beacons.

The training is preceded by ground preparation during which time the pilots, under direction of the instructor, study the scheme of piercing clouds, the operations of radio technical equipment, and become acquainted with the airfield. Having obtained data about the wind, they calculate the flight elements and landing approach and then begin training.

The instructor sets up all basic data (wind, take-off and landing course) on the instrument panel and connects the trainer. The pilot takes his place in the cockpit and begins to carry out "the flight". Observing the movements of the luminous point, indicating the actual movement of the aircraft relative to the VPP and airfield, and the indications of instruments on the instrument panel, the instructor can accurately controlling all the actions of the pilot. After each training, he analyzes the errors committed.

Training of flight personnel produces a great effect. Not so long ago, for example, the ship commander B was grounded and directed to a training unit. It was revealed here that the pilot has a very low theoretical training and in order to bring him up to par, it would be

necessary to spend many flight hours for his training. They decided to use the trainer.

At first they helped the pilot to study thoroughly the active flight by means of radio devices and to study the rules of piercing clouds and landing approach. Then on the trainer in a step-by-step manner they worked with him on each flight element by the OSP system and course-glide beacons. All this helped B to complete the training with a "good" score and at a minimum loss of flying time. The pilot was again activated and now he is flying expertly, having been appointed commander of one of the flight units.

About 00 persons were unsystematically trained on this trainer. Some of the pilots regard the trainer with disdain. This is explained by the fact that the training on it is not legalized. No matter how well the commander of an aircraft would work out the flight elements on the trainer, the actual standard of his training in the air is not reduced. If the training on a trainer would become legalized (a part of the standard training) then the attitude toward it would be entirely different.

In spite of the fact that the trainer described is not complex and not all flight elements can be taught on it, it allows, without any detriment to quality, a considerable reduction of the expenditures on the training of flight personnel. One hour of training on the link trainer is less expensive, one-fourth cheaper than on the An-2, one-third cheaper than on the Li-2 and almost one-half cheaper than on the Il-12.

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/04/03 : CIA-RDP81-01043R004000020003-8

In 1955-56, the managers of GUGVF (Main Office of Civil Aviation) workers of the NII GVF (Scient. Res. Inst. of Civil Av.) SHVLP (School for Higher Pilot Experience) and numerous commissions became acquainted with the trainer operations. Having pointed out a number of deficiencies, they made a positive evaluation of the trainer. A high opinion about the performance of the trainer was given also by the Assistant to the Chief of SHVLP, N. Pilipenko. It therefore appears strange to us that in the journal "Grazhdanskaya Aviatsiya (Civil Aviation)" No. 11, 1956, he called this trainer primitive. It is self-evident that our sample of a trainer has a number of substantial flaws but they are not connected with the structure and are explained by defects in manufacture. The designer received no technical aid as a result of which the trainer is equipped with a number of parts of different (undesired) parameters. Many of these parts are often out of commission.

All the imperfections of the trainer can be easily eliminated during mass production of the latter under industrial conditions.

True, certain comrades consider series production of the given trainer inadvisable. They propose rather to wait until the creation of a complex trainer which would offer the possibility of studying all flight elements. In our opinion, this is the wrong viewpoint. We see no sense in delaying the solution of a problem when we already have a trainer which allows one to learn one of the important flight elements - piercing of clouds and landing approach by means of radio instruments.

The introduction of the trainer will enable us to improve the training of flight personnel at considerably lower expenditures.

Moreover, it is our belief that it would be advisable to construct a replica with an An-2 cockpit. We have become convinced that An-2 pilots, having taken a training course on this trainer, handle the flights with a radio compass much better, as well as the piercing of clouds by the OSP instrument, than the pilots who took training only on an aircraft.

During mass production of the trainer in question, it is necessary to take into consideration a number of suggestions of the flight personnel: to approximate the pressure on the control organs to a point corresponding to natural conditions, to improve the indications of the PDK-45 and GPK dials, to activate piloting instruments of the right side of the instrument panel and engine performance control and to set up an arrangement for the recording of flight data. According to the constructor of the trainer, these modifications are perfectly realizable.

It is time to change from words into action. Series production of this trainer will become the basis for the change-over into the manufacture of a perfectly complex trainer.

POOR ORIGINAL

STAT
STAT

Fig. 1. Instructor of the Training Department M. Nudel'man (right) supervises the Training on a Link-type Trainer. Photo by L. Levin

Characteristics of Utilizing and Controlling Fuel for Gas Turbine Engines
by
M. Reznikov

1. The basic fuel for gas turbine engines are T-1 and TS-1 light kerosenes. They are obtained from straight run crude oil and are sufficiently stable in storage. These two types of fuel are distinguished from each other mainly by their sulfur content and density. The TS-1 kerosene manufactured from sulfur-containing crude has a higher S-content than the T-1 kerosene, and a high content of corrosion-active mercaptan, much lower end point and lower density.

The utilization of kerosene made it possible first of all to overcome successfully the difficulties connected with the boiling of the fuel at a high altitude, vapor losses through drainage and formation of vapor-air locks in the system.

The vigorous development of jet aviation has brought up the problem of enlarging the raw materials base and reducing the cost of fuel. The problem is being solved by adding benzine fractions to the fuel. Hence we obtain a much lighter jet fuel of a wide fractional composition T-2 which is obtained from straight-run low sulfur and sulfurous crude. It is inferior to kerosene by its specific heat of combustion and has a higher volatility. However, under certain conditions, T-2 has absolute advantage over kerosene especially with respect to the range of flight with greater commercial load.

Let us discuss the characteristics of utilizing, storing and controlling fuel for jet aircraft.

POOR ORIGINAL

STAT

2. The large fuel consumption at great speeds, especially supersonic, calls for the creation on board the ship of a maximum supply of thermal energy for the engines. The T-1 fuel, having a higher density, possesses a high heat of combustion (calorific value) calculated per unit of volume (liter). But an increase in the fuel load necessitates a reduction of commercial load because the flying weight of the aircraft must be maintained (not exceeded) under any circumstances.

Drawing on page 15 shows the effect of fuel characteristics on the flight-technical data of the aircraft and the performance of a gas turbine engine. It is therefore necessary to be careful with the fueling and at a high density of the fuel not to fill the tanks to maximum capacity (to the top). Here the density of the fuel and its volumetric calorific value lose their importance and the primary requirement is that it should produce (during combustion) as great amounts of heat per unit of weight as possible. T-2 which contains benzine fractions is distinguished by this quality and is cheaper.

The opinion exists that with reduction in density, we have a reduction in thrust (power) of the engines. The saying goes that it is as if the pumps measure out the fuel according to its volume. The fact is that the dosage of fuel is fixed by the pilot and is fixed automatically for a specific thrust of the engines regardless of the type of fuel used. If the fuel has low density, the tilting collar of the pump turns at a greater angle and the volumetric fuel consumption increases to such an

extent that the necessary number of calories is produced within a given unit of time.

The thrust of the engine is not affected even by the heat of fuel combustion though there are many conflicting opinions in this respect. The fuel, which yields greater heat requires more air for its combustion (Fig. 1). In addition, each engine requires only as much air as the compressor is capable of pumping at given rpm's. Consequently, the thrust here depends also upon the fixed operation of the engine.

However, as we already mentioned, these properties of the fuel have an essential effect on the range and commercial load of the aircraft.

It is stated in foreign literature that many countries are using new kinds of avia-fuel - a hydrocarbon-base fuel with much higher gravimetric and volumetric heat of combustion - obtained from crude oil by chemical synthesis and on the basis of combining elements much lighter than carbon. It is known that C constituting about 85% of the weight of petroleum fuels yields, upon combustion, 8110 calories per kg. of fuel and its lighter neighbor on the Mendeleyev periodic table of elements - boron - yields more than 13,000 cal. The element beryllium (Be) yields upon combustion 15,000 cal/kg. lithium (Li) - 20,000 cal. But the substances suitable for the combustion of compounds consisting of these elements are unstable and corrosion-active. Lengthy and serious work is required in order to make the application of these substances possible.

3. The gas dynamic characteristics of the combustion chamber of turbojet engines eliminate during routine operation any given special

Fig. 1. Relation Between Heat of Fuel Combustion and Amount of Air Consumed (According to data by A. A. Dobrynin and N. F. Nagiyev).

requirements regarding the volatility of the fuel. The air entering the combustion chamber and twisted by the straightening vanes (swirls) is repulsed by the centrifugal forces toward the walls of the combustion chamber. In the center of the forward section of the combustion chamber, a vacuum is formed and into it the hot products of combustion are drawn. It creates a reverse flow of hot gases toward the nozzle (Fig. 2). The atomized fuel coming from the nozzle is partially absorbed by the counter-stream of red hot gases where it vaporizes and chemically transforms into active inflammable substances. The remaining fuel also vaporizes rapidly in the hot stream of air which after compression in the compressor has a temperature of 200 - 400°. On the boundary line between the basic and counter-flows, the fuel air mixture is mixed with red-hot gases and is

ignited continuously as it enters the combustion chamber. Because of this process we have good vaporization and combustion of both light and heavy fuels. Only at higher altitudes, at reduced pressures and temperatures, will the combustion of a fuel of high boiling points be reduced.

Gas turbine engines must be started under conditions when the air at the combustion chamber input has a low temperature and the vaporization of the fuel containing no benzine fractions is uncertain. Gasoline B-70 is used in certain engines especially for starting. Its anti-knock characteristic (octane number) is of no importance in this case: this type of gasoline is taken only because it is well-purified and has good volatility.

As is known, conventional aircraft with gasoline burning engines develop vapor-air locks in the fuel systems during high altitude flights. Such phenomena may also occur on jet aircraft in the case of high pressure of the saturated fuel vapors.

How then are vapor-air locks originated? With the gain in altitude and drop in atmospheric pressure, we have a reduction in the solubility of the air in the fuel. In the fuel appear small air bubbles, mainly in points of narrowing or turns in the pipe lines, where the rate of flow is increased and the pressure lower, and explosions (cavitations) originate in the fuel flow. The fuel vaporizes in the forming bubbles. At a comparatively high vapor pressure, particularly in the summer, the

POOR ORIGINAL

STAT
STAT

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/04/03 : CIA-RDP81-01043R004000020003-8

bubbles become inflated. When the latter get into the pump, they disrupt the flow of fuel, disrupt the operation and can even lead to an engine stoppage. In addition, the signals indicating a drop in fuel pressure may confuse the crew.

The fractional composition of T-1 and TS-1 kerosenes eliminates the formation of vapor-air locks in the fuel system up to a great altitude. In the case of the wide fraction T-2 fuel, in the event of high pressure of the saturated vapors, vapor-air locks may form even at a lower altitude. In the event of low outside pressure, vapor-air locks appear in that section of the fuel system which is under low pressure (in the zone of the pumps). Such danger with hot fuel (temperature ≈40°) arises at an altitude of 10 to 12 thousand meters (33,000 to 39,600 ft).

At a high pressure of the saturated fuel vapors and low atmospheric pressure in altitude, the boiling of the fuel in the tanks is possible. In such a case, part of the fuel may escape through the drainage and this of course will affect the flight range.

At great altitude, the losses in T-1 and TS-1 kerosenes as a result of evaporation are not substantial. However, the same cannot be said of the wide-fraction fuel. According to foreign news releases, the losses in such fuel sometimes exceed 10%. It is perfectly possible that this is the fault not only of evaporation, but of the fact that the dissolved air is being discharged violently at a certain altitude and the vapors carry away a certain amount of the liquid fuel into the drain. In order to prevent cavitation and losses due to evaporation, sealed fuel systems

are being designed in which the fuel in the tanks is under a constant pressure of about 0.2 kg/cm^2.

The fractional composition of jet fuel will apparently be changed in the future. If, right now, for the purpose of increasing the quantities of petrol-products consumed by jet aviation, efforts are being made to utilize light benzine fractions, then, with the attainment of the so-called "heat barrier" - intensive aerodynamic heating of the aircraft at supersonic speeds - even systems with small excess pressure will not help. It is evident that it will become necessary to use a fuel much heavier than kerosene. Otherwise the losses from evaporation will become very high. Foreign periodicals carry reports about the development of a fuel for supersonic aircraft resembling Diesel fuel in fractional composition.

4. Reliable performance of the engines is the basis for flight safety. It is therefore very important that the fuel should not have a harmful effect on their parts and components. Let us discuss such a problem as the overheating or non-uniform heating of the fire tubes which contributes to their warping or destruction. The cause of the defect is due to the presence in the fuel of non-combustible substances (ashes), incomplete combustion of tars and aromatic hydrocarbons which (when settling on the wall) form carbon deposits, and also the content of a considerable amount of substances especially of the very same aromatic hydrocarbons which during combustion generate an exceptionally high temperature. The deposits disturb normal heat exchange, plug up the clearances (gaps) and reduce the mobility of parts, change their weight, gravimetric balance etc.

Fig. 2.. Diagram showing the Operation of Combustion Chamber of Gas Turbine Engine.

Jet fuel always contains a certain amount of such substances. But their content is strictly limited and should be controlled systematically during storage and use of the fuel. Anything above the permissible limits may lead to breakdowns and accidents.

Most dangerous are sulfur and some of their compounds. Free S in a small amount gets into the fuel from the crude. It can also be separated as a result of decomposition of complex organic compounds. S causes corrosion of parts made of copper alloys (bronze, brass and others). The presence of a corrosion-active free S is tested in labs by studying the effect of fuel on a copper plate.

TS-1 and T-2 refined from sulfurous crude contain small amounts of mercaptan. Under their effect jelly-like deposits (corrosion products) are being formed. When penetrating into the channels of fuel systems,

they can cause disturbance in engine control (e. g., drop in rpm) and in the final result may lead to an accident. According to technical requirements, the maximum permissible mercaptan-sulfur in a fuel is not more than 0.[illegible]%.

Testing of the mercaptan amount is as follows. The fuel is poured into a separating funnel (Fig. 3), is agitated and a blue vitriol solution of known concentration is gradually added to it. The solution reacts with the mercaptan at a specific ratio (1 milliliter : 1 milligram) and is decolored. The cessation of the reaction indicates that the entire mercaptan S reacted (the solution is not decolored any more). By the number of milliliters of added solution, we determine the number of milligrams of mercaptan and calculate their content in percentages.

A majority of other S-compounds has no effect on the fuel system components.

At petroleum refining plants, the fuel is purified of harmful admixtures by treatment with a caustic soda solution and sometimes also with sulfuric acid. The alkali and acid residues are removed with water. In spite of all the treatments, prior to using the fuel it is necessary to check whether all the residues have been removed because even if present in insignificant amounts they can cause considerable corrosion of steel and non-ferrous metals. The test is made by means of special indicators which change color in the presence of alkali and acid.

After purification (refining) the fuel, as a rule, still contains a small amount of organic, principally naphthenic, acids. These acids

POOR ORIGINAL

STAT
STAT

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/04/03 : CIA-RDP81-01043R004000020003-8

are less active with respect to corrosion of metals but their amount should not exceed the established norms.

Sometimes in fuels we have poorly settled naphthenic soap consisting of products of reaction between naphthenic acid and alkali. They can produce grease-like deposits in cisterns, storage tanks and in aircraft fuel systems. Special attention should be paid to the conditions of the bottom sections of cisterns and tanks.

Fuel should be tested during the acceptance and prior to the fueling of aircraft. It should be free of suspended and settled foreign admixtures, and should contain no water. The fuel is poured into a glass cylinder with a diameter of 40-55 mm. The presence of water is indicated by potassium permanganate which colors the water violet. It is also good to drop several potassium permanganate crystals (wrapped in gauze) into the fuel. In the presence of water, the gauze will become stained.

During a long period of storage, as a result of oxidation with atmospheric oxygen, tarry substances form in the fuel. Their amount, which should not exceed a certain limit, is tested by means of a special device. In it the fuel is vaporized and partially oxidized with a stream of air. The amount of tar is indicated by the residue.

If the fuel is not up to par, it can be improved in many cases by mixing with another fuel of the same type which has a "quality supply" (according to the indicator) which exceeds the standards. It is understood that it is not possible to eliminate mechanical impurities and water by this method.

5. Fine water droplets in the fuel freeze in the winter time. The forming ice crystals may stop up the fuel filter. Even in summer, the wetting of its felt cover leads to a slowdown in fuel feed.

The formation of water and ice crystals is also possible even in case of the most thorough inspection during the acceptance of the fuel for storing or fueling of aircraft. The truth is that the fuel dissolves a certain amount of water which is not detected. The solubility of water in the fuel differs with the temperature of the fuel (Fig. [illegible]). And so, at a temperature of 20°, each ton of fuel may dissolve 110 grams of water and, during a temperature drop to minus 10°, may dissolve 40 grams. The formation of 40 grams of ice per ton of fuel is perfectly sufficient to stop up the filters.

Ice crystals appear not only during a drop in fuel temperature but also during a rise in the temperature of the atmosphere. In this case, the moisture from the warm air condenses on the surface of the cold kerosene. In a viscous cold fuel, the ice crystals remain for a longer period of time in a suspended state.

In winter, prior to fueling, the fuel should be allowed to freeze out for a period of several days in underground reservoirs so that it will acquire the temperature of the outside air. However, even this method is not always effective. The most efficient method appears to be the physico-chemical method of increasing the solubility of water in the fuel. At present, a special liquid, "I" is being used for that purpose.

The addition of this liquid in the amount of 0.3% prevents the separation of water and formation of ice crystals during a drop in fuel temperature. The liquid also promotes rapid solution of the already existing ice crystals.

The admixture is being added at the storage houses. Its effective time period is approximately 2 - 3 months. It should be kept in mind that the "I" liquid dissolves better in water than in the fuel and in the presence of a water layer on the bottom of the volume it immediately passes thence.

The liquid "I" is hygroscopic. Prior to being added to fuel, it is therefore tested for excess amounts of water. To make this test, 50 - 100 milliliters of the fuel are poured into a separatory funnel and agitated with 1% of the "I" liquid. If the walls of the funnel show water droplets or even signs of condensation, the liquid is considered unsuitable and its application may lead to opposite results - the introduction of water into the fuel and consequently to the formation of ice crystals.

Fig. 4. Solubility of water in Kerosene T-1 (after B. A. Englin)

Fig. 3. A Separating funnel.

Electrically Heated Glass
by
S. Dekalenkov, Engineer

The front windows (windshields) of the cockpit and navigator compartment of the Tu-104 and the cockpits of the Il-14 and An-2 are protected against ice formation by internal electrically heated elements. Repair shops are now also replacing ordinary glazing with electrically heated ones in the cockpits of Il-12 and Li-2 aircraft.

Aircraft electrically heated glass consists of two layers – internal and external – glued togethor with a transparent polyvinylbutyral film (butafol). Between these layers are inserted electro-heating elements and thermistors. One thermistor is a working thermistor and the second one a spare. The working thermistor is connected into an automatic control circuit (system) which secures the heating of the outer surface of the glass at temperatures ranging from 32 to 40° (Fig. 1).

Fig. 1. Construction of Electrically Heated Glass.

There are two types of electro-heating elements: the wire type and the current conductive layer type.

The heating element of the first type consists of a number of parallel constantan wires (thin wires) 0.03 mm in diameter drawn at intervals

of 0.4 to 0.7 mm. from each other. The tips of the wires are soldered to copper busbars which are connected in turn to electric power contacts. The element operates on DC-current (24 – 28 v) supplied by the electric power system on board the aircraft.

The electric circuits of heating elements for different types of glass are determined in relation to their form and capacity required for heating (Fig. 2). The marking TSBP on the glass stands for: TRIPLEKSNOYE STEKLO BUTAFOL'NAYA PLENKA) = Triplex Safety Glass Butafol Film.

The heating element of the second type represents a thin transparent current conducting layer chemically applied to the cementing on the inside of the outer (covering) glass. Terminal busbars, leading toward the power contacts are glued to the edges of the layer.

The glass with a current conducting layer is fed with a 200 – 250 v voltage from the aircraft power system single-phase AC current or from a special 115 v, 400 cps transformer (e. g. of the PO-1500 type). An additional autotransformer is set up for the purpose of boosting the voltage.

The TOS(M) or TOS thermistors used in electrically heated glass consists of a semiconductive mass. They are manufactured in the form of small tablets 5 – 6 mm. in diameter with connecting wires soldered to their upper and lower surfaces.

At a temperature of 20°, the thermistor has a resistance of 5000 – 8000 ohms which drops sharply as the thermistor becomes heated. For ex-

POOR ORIGINAL

STAT

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/04/03 : CIA-RDP81-01043R004000020003-8

ample, when the TOS(M) is heated from 20 to 45°, its resistance changes by more than 2000 ohms.

The glass surface heating temperature is maintained within certain specific limits by means of a special AOS-81M automatic mechanism, whose operation is based on a bridge circuit (Fig. 3). Two adjoining arms of the circuit represent windings of a sensitively polarized RP-4 type relay and two other arms consist of the adjusting resistance R_p and thermistor R_t. One diagonal of the bridge is short-circuited: the second is fed 26-29 DC-volts from the power system on board the aircraft.

During normal temperature of the glass, the contacts of the RP-4 relay are closed. As the temperature of the outer glass surface increases to 32 - 40°, the resistance of the thermistor drops. The currents in the arms of the bridge circuit and the windings of the RP-4 relay are redistributed and the contacts open up. This leads to a contact breaking of the more powerful RV3-45 relay of the automatic mechanism and the feed circuit for the contactor winding connecting the heating element is disrupted. After the heating element is cut off, the glass begins cooling off, the thermistor resistance increases and, upon reaching a specific value, it activates the RP-4 relay. Its contactors are closed by the RV3-45 relay and the connection contactor activates the electric heating circuit.

In this way the temperature of the outer glass surface is automatically maintained within certain fixed limits by a periodic switching

off-and-on of the electric heating element.

The AOS-81M automatic mechanism has three independent channels and can control simultaneously the heating of three aircraft windows. On aircraft with only two electrically heated windows, one of these channels is the reserve one. The adjusting resistances of the automatic mechanism are situated on the front panel, the axes of their cursors are covered with a lid. The resistances are designated by the letters L, SH, and P meaning - L - left glass, SH-navigator's glass and P - [illegible] glass.

Such automatic mechanisms are used on all aircraft regardless of the capacitance of the electro-heating elements and type of power supply source.

In aircraft repair shops where the glazing on the Il-12 and Il-2 is being changed a technical documentation system was introduced and is being maintained: special riggings and instruments (tools) were designed and necessary improvements and changes in drawings were made.

At first there were instances where the AOS-81M automat adjusted at the factory was unstable in operation with the window thermistors because of the "humming" of the RP-4 relay. For this reason it is necessary first (prior to installing) to adjust the heating automat into uniformity with the thermistors and relay before the electrically heated glass is installed on the Il-12. Engineers I. Ya. Koldin, A. A. [illegible] and mechanic S. S. Bakhmet'yev have devised a relay testing system mounted on the [illegible]-1 stand which allows an adjustment of the heating automat separately and in combination with the glass. An identical job was carried out also on the Li-2 by A. V. Korol'kov N. F. Gusev and Ye. Ye. Tomak.

Fig. 2. Drawings of Electric Wire-type Heating Elements.

Fig. 3. Principal Circuit Diagram of Automatic Control of Window Heating

At present all repair shops of the Civil Aviation are provided with special attachments to the UPR-1 stand, made according to the design charts of the State Scientific Research Institute of Civil Aviation. These attachments make it possible to test glass supplied with either DC or AC voltage. Preliminary testing and adjustment offer the possibility of eliminating unstable performance of the automat on the aircraft after the system is already installed.

Four additional protective units in the heating circuit of the Il-12 aircraft have made installation very difficult and, in addition to the cramped conditions, the central distribution control boxes made the maintenance (servicing) of its equipment inconvenient. In this connection (during the installation of glass on the Il-12) it was necessary to discharge the busbar of the central distribution system. Upon the initiative of repair shop chief Z. N. Eyger and foreman N. F. Golovlin, all fuses of the radio equipment are placed in a special equipped box with an easily opening lid. The busbar of this box is connected to the busbar of the TSRU (central distribution control box) by means of a wire with a cross section of 25 mm^2 through an IP-150 fuse. In this way, we secure an adequate supply of fuses in the TSRU and convenience in the operation and maintenance. The box is mounted on one of the windows in the radioman's cabin.

This principle of protecting circuits of radio equipment is now in force on all Il-12 aircraft during the replacing of ordinary glass with electrically heated units.

POOR ORIGINAL

STAT

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/04/03 : CIA-RDP81-01043R004000020003-8

A number of modifications were suggested and introduced on the Li-2 aircraft by engineer V. D. Tafropolskiy and foreman V. G. Morozov.

When adjusting the heating automat in combination with the glass on the stand as well as directly on the aircraft, it is necessary to measure the outer surface temperature of the glass. Engineer A. F. Tal-vushko (from one of the avia-repair shops) while conducting certain experiments, developed the construction of the ET-1 electric thermometer equipped with a remote sensing element (Fig. 4). The thermometer employs a bridge circuit. One arm of the bridge - the sensing element - consists of a copper wire resistance 0.06 mm in diameter wound on a flat insulation plate. A milliammeter calibrated in degrees serves as an indicator. The thermometer is fed from a flashlight battery which is inserted in the body of the thermometer. The utilization of such a thermometer has facilitated the acceleration of the process of controlling the automatic mechanism and the increase of the measurement accuracy.

Electrically heated panes with a wire element have a number of deficiencies as compared with the current conducting layer glass. The presence of closely situated thin wires, covering almost the entire surface of the glass, produces parasitic optical phenomena. When flying toward the sun or during night landing on an illuminated airfield, iridescent bands appear in the glass and produce an indistinct picture of the lights. This takes place regardless of the on or off position of the electric heating of the glass.

In Li-2 aircraft, due to insufficient power of the feed source during the operation of the electro-heating system, it becomes necessary to cut out or limit the performance of other electric power users on the aircraft. For example, when flying under icing conditions, and also during the taxiing and prior to take-off, the heating of the right and left windows should be switched on alternately. When the heating is on for both windows, it is absolutely necessary to watch the readings of the aircraft ammeters so that the load does not exceed 55 amp. When flying with one engine out of commission and connected glass heater, it is necessary to shut off all other electric power users except the cockpit light, radio compass supply, duty light and radio receiver. Electric heating of windows should be disconnected when two-way radio conversations are carried out on the aircraft.

On the Tu-104, Il-14, Il-12 and An-2, we do not have such limitations connected with electric power shortage.

In aircraft with electrically heated glass equipped with wire heating elements, the KI-11 magnetic compass which is situated close by gives untrue readings during the operation of the heating system. This is due to the effect of the electric field. When the magnetic KI-11 compass is in operation, the electric heating of windows must be disconnected.

It has been established from experience that the window electric heating system functions faultlessly in spite of the deficiencies and requires no special care. Only periodic checks of the adjustment and

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/04/03 : CIA-RDP81-01043R004000020003-8

fastening of the automat are necessary. Furthermore, at low temperatures the heating should be connected in pulses for gradual heating of the glass surfaces. In the case of extreme icing, it is necessary to use the electric heating and the warm air from the cockpit.

In case one of the thermistors is out of commission (break in internal connections, short circuiting, etc.) it is necessary to use the reserve thermistor and readjust the AOS-81M automat. When both thermistors are out of order, the electric heating system cannot be used.

Fig. 4. Electric thermometer TT-1 for Measuring Temperature of Glass Surfaces.

Thanks to the introduction of electrically heated glass, the aircraft of the Civil Air Fleet have discontinued using rectified alcohol in the the role of anti-icing liquids for cockpit windows.

Glass with current conducting layers have certain advantages. The parasitic optical phenomena, characteristic of glass with wire elements, are unknown here. The connection of the glass heating system has no effect on the magnetic compass because the heating element is fed low voltage AC-current. However, this type of glass is not yet in widespread use by the Civil Air Fleet.

The existence of electrically heated glass facilitates flight operations under complex (adverse) meteorological conditions. It is a step forward in the improvement of aircraft de-icing systems.

* "Gyrohorizon" as used in above translation can also be rendered "gyro horizon" or "gyroscopic horizon" -Editor's Note.

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2014/04/03 : CIA-RDP81-01043R004000020003-8